UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

August 1, 1984

OFFICE OF
THE ADMINISTRATOR

Honorable William D. Ruckelshaus
Administrator
U.S. Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460

Dear Mr. Ruckelshaus:

The Science Advisory Board has completed its review of the Office of Research and Development's (ORD) university-based Research Centers Program. The Board's review was carried out by its Subcommittee on Strategic and Long-Term Research Planning. The Subcommittee examined a number of issues related to the centers program including the role of the centers in ORD's research program; the quality of work performed by the centers; the EPA budget process and support for centers; ORD management of the centers and the adequacy of ORD leadership; and identification of options for evaluating and/or reviewing centers.

In general, the Subcommittee concluded that most of the centers it reviewed can be judged successful if criteria such as research design and quality, and relevance to EPA's needs are utilized. However, the Subcommittee identified a number of shortcomings limiting the ability of these centers to be highly productive research institutions. Chief among those factors were overmanagement of the centers by EPA, resources insufficient to constitute a critical mass of support, and the poor quality of EPA leadership for the centers program. The Subcommittee has made a number of recommendations for resolving these and other problems, and we would appreciate your response to these ideas. In addition, it is our understanding that ORD staff are presently developing criteria for decisions on the renewal of centers as well as changes in the management of the program. We would appreciate receiving a briefing on these initiatives.

Thank you for the opportunity to present our evaluation of this program. We believe that if it is sufficiently funded and appropriately managed it has the potential to be a truly significant and productive component of ORD's research program to address many of EPA's most important information needs. The recommendations by the Board for improving the productivity of the centers should be regarded as suggestive rather than prescriptive. The SAB is interested in being informed on EPA's plans to resolve these shortcomings.

Sincerely,

Norton Nelson, Chairman
Executive Committee

John Neuhold, Chairman
Subcommittee on Strategic
and Long Term Research Planning

cc: Mr. Alvin L. Alm
Dr. Bernard Goldstein
Dr. Herbert Wiser
Dr. Terry F. Yosie

REPORT OF THE SUBCOMMITTEE ON STRATEGIC AND LONG-TERM RESEARCH PLANNING

REVIEW OF THE RESEARCH CENTERS PROGRAM OF THE OFFICE OF RESEARCH AND DEVELOPMENT

United States Environmental Protection Agency
Science Advisory Board
Washington, D.C. 20460

JULY 1984

NOTICE

This report has been written as part of the activities of the Environmental Protection Agency's Congressionally established Science Advisory Board, a public group providing advice on scientific issues. The Board is structured to provide a balanced, independent, expert assessment of scientific issues it reviews, and hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency nor of other agencies in the Executive Branch of the Federal government.

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Key to Acronyms

AA	-	Assistant Administrator
AECTRC	-	Advanced Environmental Control Technology Research Center
CASAC	-	Clean Air Scientific Advisory Committee
EPA	-	Environmental Protection Agency
HERL	-	Health Effects Research Laboratory
IERL	-	Industrial Environmental Research Laboratory
MERL	-	Municipal Environmental Research Laboratory
NCGWR	-	National Center for Ground Water Research
NIEHS	-	National Institute of Environmental Health Sciences
NIH	-	National Institutes of Health
OER	-	Office of Exploratory Research
ORD	-	Office of Research and Development
RSKERL	-	Robert S. Kerr Environmental Research Laboratory
SAB	-	Science Advisory Board
SAC	-	Scientific Advisory Committee
SRC	-	Scientific Review Committee

I. EXECUTIVE SUMMARY

This is the final report of the EPA Science Advisory Board's (SAB) review of the Office of Research and Development's (ORD) university-based research centers program. The Board's review was carried out by the Subcommittee on Strategic and Long-Term Research Planning which was formed to provide advice on a series of long-term research and development issues confronting EPA.

The Subcommittee has focused on six major issues in its review of the research centers program. These include: 1) the role of the centers in ORD's research program; 2) the quality of work performed by the existing centers; 3) the EPA budget process and financial support for centers; 4) EPA management of the centers program; 5) the adequacy of EPA leadership for the centers program; and 6) options for evaluating and/or renewing centers.

The Subcommittee finds that neither the criteria for evaluating the centers performance nor the mission of the centers program has been clearly established by ORD. This has led to a great deal of confusion within ORD and between ORD and individual centers regarding the appropriate role of centers in ORD's research program. Although most centers visited by the Subcommittee can be judged successful if one uses criteria of research design, quality and relevance to EPA's needs, it is equally clear that the centers program can not be termed successful. The centers program exists in a vacuum insofar as EPA's research planning process is concerned and thus, it has had no discernable impact upon how EPA identifies its research needs.

There are a number of ways of resolving these problems and achieving a clarity of purpose for the centers program. These include: 1) ORD should prepare guidance which clearly establishes the mission of the program and defines criteria by which the goals and performance of the centers can be measured; and 2) ORD should define EPA's high priority health and environmental research needs for the next five to ten years and identify which of these needs can be addressed most effectively by centers.

The quality of work performed by most of the four centers visited by the Subcommittee is generally high. Factors such as the design and focus of the research program, research quality and quality assurance are given high priority by the center directors and their staffs who have also evolved constructive relationships with their respective Scientific Advisory Committees. In general, the number of linkages between the centers and their affiliated universities continues to grow, thus drawing a wider spectrum of disciplines and talents under the centers' umbrella.

A major limiting factor to the achievement of high levels of research productivity by the centers is the lack of adequate budgetary support. The dimensions of this problem are two-fold. First, the process by which centers receive their annual budget is counter productive to center research

performance. After extensive preparation and review of their research plans by several layers of EPA management, the centers' budgetary allocations are made without a clearly defined rationale and at a level of funding considerably below the target allocations given to the centers to guide their research planning for the following fiscal year. A second set of problems stem from insufficient levels of support. The current budget of $420,000 per center per year is simply not adequate to constitute a critical mass of resources to achieve high levels of research productivity.

The Subcommittee recommends that a number of steps be taken to resolve problems related to budgetary process and support. These include: 1) allocations of resources should be received by the centers at the start of the annual project period; 2) ORD should identify ways to streamline the multiple layers of review in the centers' budget cycle, including further delegations of authority to the level of ORD where the responsibility lies for managing the centers program; 3) ORD should distinguish between those portions of a center's budget that constitute core support and those that comprise funds for research; 4) centers should be free to supplement core support resources by any means that does not constitute a conflict of interest or run contrary to the mission of the centers program; and 5) the support needed by most centers to maintain a high level of research productivity ranges from a minimum of $800,000--$1,000,000 per year to a maximum of $2,000,000 per year (including core support and research funds).

The centers program is both overreviewed and overmanaged by EPA. The combination of policy board reviews, Scientific Advisory Committee reviews and periodic administrative reviews by ORD headquarters -- in addition to budgetary reviews -- are excessive given the amount of resources allocated to the program. Administrative costs consume a minimum of 20-25% of the centers' budget which is an excessively large fraction of resources at the current level of funding.

The Subcommittee recommends that the following measures be implemented to resolve these problems of overmanagement: 1) both the policy board and Scientific Advisory Committee should meet only once per year, ideally at the same time; and 2) ORD should clarify a number of institutional relationships associated with the centers program, including: a) the relationship between the project officer and the policy board chair--where possible, the two positions should be held by the same individual, preferably a senior laboratory official; b) the stability of the policy board and the knowledge of its members. Board members should be appointed for fixed terms, staggered so as to facilitate the continuity of knowledgeable members while gradually introducing new participants; and c) the role of ORD headquarters and the Assistant Administrator in annual sign-off support for the centers. ORD headquarters review need only occur when a center is up for a renewal decision. There is no need for the Assistant Administrator to annually approve a center's funding.

One of the most troubling of all the issues addressed by the Subcommittee in its review of the centers program was the quality of leadership in ORD's Office of Exploratory Research (OER). Throughout the program's existence

there has been no effective senior spokesperson or advocate for the centers within EPA, particularly at headquarters. As a result, the centers are treated as orphans whose existence is tolerated, but they are not adequately supported or effectively utilized. The Subcommittee believes that the Assistant Administrator must become the advocate for the program, for this is the individual who has the scope of authority and span of control to successfully utilize the scientific talents in residence at the centers.

It is not clear how knowledgeable or concerned the current OER leadership is about the many problems that beset the centers program. The Subcommittee recommends that future directors of OER possess scientific competence and professional experience in managing a long-term research program, have the support and respect of the scientific community and senior policy officials at EPA, be able to provide the intellectual leadership necessary for a centers program, and be capable of clear communication of policy decisions and management guidance.

The Subcommittee reviewed a number of options for evaluating and/or renewing centers and identifying new center themes. The Subcommittee recommends that funding of centers be based on a three year cooperative agreement, followed by a second three year cooperative agreement. Competitive renewal should occur in the fifth year. If the center receives a competitive renewal it would obtain two additional three year cooperative agreements. If it is not renewed, it should receive 50% of its funding for an additional year (year seven) as a transition to a total phasedown. Additional criteria that should be incorporated into ORD's decision whether to renew a center include the design and focus of the centers research program, research quality and control, quality assurance, and intra- and inter-university linkages developed by the center. ORD, however, should feel free to consider other mechanisms for evaluating and reviewing centers, including those in place at other Federal agencies.

The Subcommittee strongly recommends that ORD and the Agency resolve the major problems that plague the existing centers before even considering the establishment of new centers. At the present time it would be foolish to consider new centers before the current budgetary, leadership and management problems are corrected. If such efforts are made, and if they are successful, there are at least five high priority research areas which the Subcommittee draws to the Agency's attention. These include: 1)extrapolation of quantitative animal response data for the prediction of human responses; 2) research relating air pollution exposures to doses received by target sites within human populations; 3) evaluation of unused areas for waste disposal: 4) application of biotechnology principles and techniques to pollution control; and 5) monitoring of ambient levels of pollutants in air, water and soil. A fuller discussion of these research opportunities is included in the text of the report.

II. INTRODUCTION

This is the final report of the EPA Science Advisory Board's (SAB) review of the Office of Research and Development's (ORD) university-based research centers program. This review was conducted by the Board's

Subcommittee on Strategic and Long-Term Research Planning. The Subcommittee was formed by the SAB's Executive Committee on December 9, 1983 to identify specific areas in which the SAB could advise ORD and the Agency on a number of long-term research and development issues related to the Agency's mission to reduce human health and environmental risk from anthropogenic activities. The review of the centers program is the second of what is expected to be a series of Subcommittee reports.[1]

The SAB review of the centers program was requested in December 1983 by Dr. Bernard D. Goldstein, Assistant Administrator for Research and Development. Dr. Goldstein specifically solicited the SAB's input to assist ORD in its own evaluation of centers prior to determining whether and under what conditions to renew existing center agreements. The specific charge to the Subcommittee was "1) examining what environmental areas and themes will be of highest priority for the centers program; 2) assisting ORD in conducting a scientific review of the centers, associated with ORD's scientific and management review of the program; 3) reviewing the effectiveness of the centers program as a means of carrying out ORD's mission; 4) advising on the quality of the work performed by the centers; 5) advising ORD on the issue of options for renewal of centers; and 6) examining how research results generated by both the Research Centers Program and the Peer Review/Investigator Initiated Grants Program can be more effectively communicated to ORD's laboratories and to EPA's program offices." The complete Subcommittee charge is included as Appendix A.

To carry out the review of the centers program, the Subcommittee recruited a number of scientists and engineers representing a diverse set of scientific disciplines and institutional affiliations. The review panel embodied expertise and experience on both bench research and research management levels. The roster of the Subcommittee is presented as Appendix B.

A. History of the Centers Program

The concept of a research centers program within EPA originated in the 1970's as the outgrowth of a concern over the direction of the Agency's research program. Reports prepared by the Office of Technology Assessment in 1976, the National Research Council in 1977, and The President's Office of Science and Technology Policy in 1979 called to the attention of Congress and EPA policymakers the need to balance the Agency's shorter-term needs for technical assistance for regulation development with a commitment to support research directed to longer-term research projects and programs that would improve the scientific basis of regulatory decision making. In particular, these groups believed that EPA had the responsibility to identify research gaps and foster advances in the state of scientific knowledge to ultimately serve EPA's regulatory information needs. In Fiscal Year (FY) '78 the Congress required EPA to assess laboratories needed to support long term research. On April 5, 1978 the Agency submitted to the Congress a report that examined a number of alternative approaches for conducting long-term environmental research. A key recommendation of the report was

[1] See also the Preliminary Report of the Science Advisory Board Study Group on Strategic and Long-Term Research Planning, December 7, 1983.

that "EPA should draw upon and utilize existing institutional resources as one method of filling research gaps. Approximately five to ten centers of expertise should be supported primarily at existing institutions with specialized expertise.... Approximately, $500,000 to $1 million will be required annually to support each center."

The Agency followed up this report by appointing a task force to identify themes of interest. A newly formed Office of Exploratory Research (OER) prepared concept papers for each theme. These became the basis for a wide solicitation of letters of intent from interested universities. After reviewing the letters of intent, EPA invited selected universities to submit formal proposals for the competitive awarding of a cooperative agreement for each center theme.

Beginning in FY'79 EPA authorized cooperative agreements with eight university based centers. The centers and their respective starting dates are listed in Appendix C. A funding history of the centers program is presented in Table I.

Table I: Funding History of ORD Research Centers Program

Fiscal Year	Amount Allocated to Program (millions of $)
1980	2.8
1981	4.9
1982	6.3
1983	3.4
1984	3.4*
1985	3.4**

* Current estimate of actual dollars to be expended
** Administration's request to the Congress for FY'85

B. Subcommittee Review Procedures

The Subcommittee held three public meetings on February 3, March 14-15, and May 17-18, 1984. In addition, the Subcommittee subdivided into four groups to conduct site visits during the month of April. The sites visited included the Epidemiology Research Center, the Advanced Environmental Control Technology Research Center, the National Center for Ground Water Research, and the Ecosystems Research Center.

The Subcommittee analyzed previous reports on the program by EPA and the centers. Extensive briefings were provided to the Subcommittee by EPA staff (including representatives of ORD headquarters and laboratories), representatives of the policy boards, and center directors and their staffs. From these briefings the Subcommittee learned about EPA's management of the program, ongoing and anticipated research activities carried out by the centers, and specific problems and opportunities associated with the program as a whole, as well as those related to specific centers. This information served as the basis of the Subcommittee's findings and recommendations.

Both Agency and center staff were extremely helpful in providing the information needed to respond to the issues listed in the charge. The Subcommittee appreciates this cooperation and wishes to acknowledge the contribution of all of the individuals associated with the centers program.

C. Outline of this Report

The body of this report consists of two major sections. Section III presents an analysis of the major strengths and weaknesses of the centers program, encompassing such factors as the scientific quality and relevance to EPA of research carried out by the centers and EPA's management of the program. The Subcommittee's findings and recommendations are presented in Section IV.

III. STRENGTHS AND WEAKNESSES OF THE CENTERS PROGRAM

A. Criteria for Establishing Centers and Definition of Centers' Mission

The Subcommittee's review of Agency documents and interviews with Agency and centers' personnel reveal a wide disparity of opinion about both the criteria for the establishment of centers and the mission that the centers were to perform. For example, ORD staff informed the Subcommittee of five criteria that were originally used to review applications and select centers. These included: 1) the scientific quality and creativity embodied within a university's proposal to receive a center; 2) the university's ability to develop innovative solutions; 3) qualifications of the researchers; 4) university facilities; and 5) experience of the university personnel.

These criteria contrast with those provided in the OER concept paper for developing center themes entitled "General Guidance for Centers". Examples of criteria identified in this document include: 1) "centers and their programs shall have a multimedia and multidisciplinary orientation..."; and 2) "center programs must be responsive to the long-term needs as perceived by all EPA laboratories whose activities are related to the center objectives."

A similar diversity of viewpoints characterized the definition of the centers' mission. The solicitation announcement for the original centers emphasized that they would augment EPA's ongoing long-term research program.

However, discussion at an early policy board meeting of one newly formed center indicated that approximately 10-20% of the center's funds were to be earmarked for studying problems of immediate interest to the Agency.

In short, both the criteria for establishing the centers and the mission of the centers program have not been clearly articulated by EPA.

B. Comparison of Centers Program Accomplishments With Original Goals and Criteria

A major rationale for the establishment of the university-based centers program was to carry out research designed to meet EPA's longer-term information needs as identified by the Congress, the National Research Council, the Office of Technology Assessment, and EPA internal task forces and advisory committees. When eight centers were established between 1979 and 1981, both the selected universities and many senior ORD officials had high expectations regarding the program's potential. EPA officials, in particular, saw the program as a means to establish more formal linkages to the scientific community, with the hope that such ties would lead to advances both in scientific knowledge and in the credibility of the Agency's research program.

A major difficulty in assessing the accomplishments of the centers program lies, as noted in the previous section, in the absence of clearly defined criteria against which to judge performance. In theory, the OER solicitation statement for each theme describes the original goals of each center. However, as centers were established, it became clear that there was no unified policy to evaluate the centers' operations. Even solicitation statements were not consistently used as policy statements. Without adequate and consistent guidance from ORD headquarters, policies were developed on an ad hoc basis for individual centers, in response to specific questions raised by a particular center. Individual cooperative agreements, therefore, may contain policy specifications peculiar to one university.

An additional difficulty in weighing the centers' performance is the erratic budgetary history of the program. As seen in Table I, the budget increased steadily from FY'80 through FY'82, but beginning in FY'83 a sharp decline in resources ensued. This up and down trend of resource availability is disruptive to any research program, but it is particularly disruptive to the planning cycle of research projects of several years' duration.

Given this ambiguity in both ORD policy and funding, what have the various centers accomplished in their three to five years of existence, compared to what was expected by OER or the leadership of ORD?

It is apparent that some centers have accomplished essentially what EPA had in mind, and in some cases even more than EPA should have expected or deserved given the vicissitudes of the EPA budget, changing leadership in OER and contradictory programmatic guidance. The Epidemiology Research

Center, however, had no clearly defined mission for the first three years of its existence and its performance during this period reflects this lack of definition.

The extent to which the centers program is judged "successful" depends in large part upon the criteria used in measuring its impact on research-related functions of EPA. The original concept of EPA-funded centers, as opposed to university-based centers supported by the National Institutes of Health (NIH) and other Federal agencies, was that EPA and the university scientists would jointly plan and manage research that could not easily be conducted in EPA's own laboratories. EPA's research would be enriched, extended, and strengthened by long-term and exploratory research in the university--the kind of research that is difficult to nurture in an EPA laboratory because of regulatory pressures to acquire short-term data in support of specific programmatic activities. These principles are embodied in the concept of cooperative agreement funding and in the role of the policy boards.

If one examines the centers program from the viewpoint of: 1) criteria for joint research planning; 2) feedback of research findings into the regulatory process; 3) general enrichment of EPA's research efforts; and 4) exchange of scientists between centers and EPA laboratories, there is little evidence of success. The centers have almost no discernible impact on EPA's research planning process, and the planning process (in contrast to the budget process) has very little impact on the centers. The centers exist as if in a vacuum and have had no discernible impact upon how EPA identifies its research needs. Thus, a major purpose of the centers program has not materialized to a significant extent.

The value of the centers program and its impact on EPA should also be judged by other criteria. Ideally these criteria would include the quality and quantity of the long-term or exploratory research, the relevance of this research to EPA's long-range needs, and the timely availability of the research information to EPA's laboratories and program offices. Related criteria would be whether the centers program has attracted mature scientists in various departments of a university to engage in EPA mission-related research in which they would not otherwise be engaged, and whether the centers are attracting younger faculty members, graduate students, and post doctoral fellows into the environmental sciences.

The Subcommittee did not attempt to develop a quantitative assessment of the centers in terms of these criteria. Nevertheless, the site visits and the meetings with center directors and policy board chairmen yielded abundant examples of fundamental research closely relevant to EPA's problems, fruitful interactions between centers and EPA laboratories, recruitment of both younger and mature scientists, development of new academic courses, and other activities which demonstrate that an EPA-university connection has mutual benefits. These examples will be cited throughout the text of this report.

In the Subcommittee's view, the principal factors leading to success for this program are high quality of center leadership, comparable quality and consistency of policy board and ORD leadership, degree of university support and quality of university personnel, and adequate EPA resources. Where one or more of these are lacking the center has been less successful and even disappointing. What is critically needed at the present time to promote the success of the centers program as a whole is a continuity and a quality of leadership in ORD headquarters that understands what a centers program should provide to EPA, what factors lead to success or failure, and what management and budgetary resources are necessary for a successful program. In summary, the centers program cannot be proclaimed a success story. However, the reasons for this result rests primarily with the inadequacy of ORD leadership and support rather than with the universities.

C. Research Quality Review Criteria

The research quality review criteria identified in the Subcommittee charge and utilized to evaluate the quality of work performed by individual centers were jointly developed by ORD and SAB staff and were accepted by the Subcommittee in its charge (See Appendix A). These criteria formed the basis for soliciting information and formulating opinions on the work performed at the Epidemiology Research Center, the National Center for Ground Water Research (NCGWR), the Ecosystems Research Center, and the Advanced Environmental Control Technology Research Center (AECTRC).

1. Design and Focus of the Research Programs at Four Centers

The program at the NCGWR focuses on the fate of organic chemicals in the subsurface environment including both saturated and unsaturated Ground Water conditions. It is a multi-university, multi-department, multi-discipline program. The researchers have training and experience in civil and chemical engineering, chemistry, physics, mathematics and biology. In developing its program, the center has aimed at the long term. Some of its best work is fundamental and clearly identifies new and important phenomena about partitioning and transport of chemical species in ground water. This program has shown the ability to cross departmental and institutional barriers to bring a multidisciplinary group together. Its talents are broader and stronger for ground water research than the current EPA funds can support.

At the Ecosystems Research Center the program is multifaceted, involving both review and synthesis and modelling efforts. An example of a review and synthesis effort is the development of a multi-authored treatise on ecotoxicology, an emerging field of toxicology. This is of particular value in the area of setting water quality criteria under the Clean Water Act. Modelling efforts have long been used to simulate complex physical and biological systems. The center has employed this tool to pinpoint subsystems in the aquatic ecosystems surrounding drilling platforms for early warning monitoring.

The research program at the AECTRC focuses on air and water pollution control. Each of the research projects is aimed at gaining a fundamental understanding of mechanisms to improve control processes. The researchers are primarily faculty members from the college of engineering who hold appointments in the civil or chemical engineering departments. Several of the investigators have advanced degrees in physics, chemistry, or biology as well as engineering. Near-term research addressses topics in biological degradation of pollutants on activated carbon, regeneration of spent activated carbon, ozone and hydrogen peroxide oxidation of dissolved hydrocarbons, and surface properties and charge on aerosol collection efficiencies. Longer-term research is examining fundamentals of super critial fluid extraction. In addition to EPA support, many of the researchers have other government agency and/or industry research support, and thus the EPA gains by having a highly trained staff, not fully supported by the Agency, working on projects that are of interest to EPA.

There has been extensive occupational epidemiologic research and some environmental epidemiologic research by faculty members associated with the Epidemiology Research Center, but most of the research has not been identified with or funded by the center. Only in the past nine months has the center identified environmental research areas in which it plans to develop research programs. These include development of methods for epidemiologic study of populations impacted by hazardous waste dump sites; improvement of methods for surveillance of reproductive effects; volatilization of chemicals from potable water as a source of indoor pollution; and improvement of risk assessment methodology based on epidemiologic studies. These are appropriate topics for long-term study, given the competencies and interests of core and resource faculty in this center. The new director and associated faculty members in epidemiology and biostatistics have well-earned reputations for high quality research in occupational epidemiology.

2. Research Quality and Control

A simple means to judge research quality and control is to measure peer acceptance of research output. Each of the reviewed centers uses its Scientific Advisory Committee (SAC) a little differently to ensure the quality of its research projects and publications. For example, at the NCGWR there is competition for research funds through a process of submitting internal proposals from each of the three universities that are part of the center. Quality control is maintained by both a pre-proposal and post-project review. Preproposals are solicited and reviewed by the three center co-directors as well as by scientists and engineers from the Robert S. Kerr Environmental Research Laboratory (RSKERL), Ada, Oklahoma, for relevance and to avoid duplication of efforts. Full proposals are prepared, reviewed, and ranked by the SAC. The co-directors use this ranking to determine which projects are to be supported. The policy board reviews these projects and the yearly work plans.

ACETRC uses its Scientific Advisory Committee to review and approve individual research proposals and to conduct periodic reviews of completed research projects. The SAC, in conjunction with the policy board, addresses the relevance of the research program to EPA with the purpose of initiating new research themes as well as deciding if certain project areas should be phased out. The research staff of this center has excellent credentials, and their reputations lend to the scientific credibility of the center's activities. For example, one assistant professor was recently recognized with a Presidential Young Investigator Award, and the center director is a member of the National Academy of Engineering.

The Ecosystems Research Center uses a Scientific Review Committee (SRC) to evaluate the work of both the staff and the Scientific Advisory Committee (SAC). This independent panel of ecologists is nominated by the center director and approved by the policy board chairman. The SAC provides guidance as programs are initiated, whereas the SRC provides mid-course and end product evaluation.

In contrast, the SAC of the Environmental Epidemiology Center has been underutilized until this year. However, the SAC now has a regular meeting schedule. Its principal function is to review research proposals and participate in quality evaluation.

3. Quality Assurance

When the centers program was first initiated, the competitive process between universities was used by EPA to identify high quality institutions and staff committed to its announced goals for the centers.

The principal products of the centers are written reports or papers that are prepared for publication in peer reviewed journals. Acceptance and publication of these papers is taken as explicit recognition that the work is acceptable to the scientific community.

In the particular case of the Epidemiology Research Center, conventional laboratory practices for quality control are of limited application since laboratory or experimental science plays a small role in this center's activities. The data of epidemiologic studies, such as death certificates, have well known problems of accuracy, completeness, bias, and other sources of variability. However, as statisticians and epidemiologists, the key faculty are familiar with these problems and the measures to reduce their impact.

At the three centers where laboratory or experimental science play a more significant role (NCGWR, AECTRC, and the Ecosystems Research Center), quality assurance is adequately addressed throughout the data collection and interpretation phases.

4. EPA-Center Communications

Interactions between EPA and the centers have taken several forms. The Subcommittee has not attempted to characterize or offer opinions on all means of communication; rather, it has identified several areas that it believes are representative of EPA staff's attitudes and management approaches toward the centers.

EPA staff from ORD headquarters and laboratories and the program offices serve on the policy boards that provide oversight and articulate policy and programmatic guidance and goals for each center. In general, the Subcommittee found that the policy boards it examined have, over time, appropriately evolved into oversight units that have attempted to facilitate center operations. For example, the director of the Robert S. Kerr Environmental Research Laboratory in Ada, Oklahama, who chairs the policy board for the National Center for Ground Water Research, has made diligent attempts to obtain funds for this center.

Both Office of Exploratory Research and policy board guidance should be consistent. Even generally supportive policy boards, however, sometimes raise obstacles when their relationship with OER or the Assistant Administrator's office is unclear. The policy board for the Advanced Environmental Control Technology Research Center (AECTRC), for instance, at one point stated its desire to approve the terms by which an industrial group would fund a center project even though no conflict of interest was apparent. This was unacceptable to the industrial representatives who subsequently declined to co-sponsor the project.

Perhaps the worst example of EPA-center communication breakdown existed at the Epidemiology Research Center which has not sought non-EPA external funding in part because of difficulties in gaining policy board approval. The policy board chair for this center has experienced a deplorably high turnover rate; in the five years of its operation, there have been five different chairs. This lack of stability has contributed to the difficulties experienced by the center in obtaining consistent EPA guidance. In addition, a number of the center's activities involved EPA's requests for reviews of criteria documents, grant applications and research protocols. The Subcommittee concludes that these technical assistance activities have been excessive, and many are inconsistent with the stated purpose of a center.

The most fruitful center-policy board communication patterns observed by the Subcommittee occurred when policy board representatives were EPA laboratory employees. This is true for at least two reasons. First, ORD laboratory personnel are more likely to possess the technical expertise necessary to understand and review center activities. Second, laboratory representatives, in contrast to ORD headquarters or program office staff, can more readily regard their center counterparts as scientific colleagues. Such colleague-to-colleague interactions are, in selective instances,

beginning to bear fruit. For example, cooperative research ventures have evolved between the Ecosystems Research Center and both the Gulf Breeze and Corvallis laboratories. Similar endeavors are transpiring between AECTRC and the Municipal Environmental Research Laboratory (MERL) in Cincinnati. The Deputy Director of the Industrial Environmental Research Laboratory in Cincinnati is also the project officer and policy board chairman for the AECTRC and the other two technology centers. This arrangement has promoted direct exchanges of information between the laboratory and the centers and within the centers.

Such examples represent an improvement in laboratory-center relations since the time when the centers were first established. At that time, research funds were withdrawn from the laboratories to support the centers' operations. This "tapping" of the laboratories by the Assistant Administrator produced an understandably negative reaction by laboratory directors and staff. In subsequent years the laboratories have, until the very modest budgetary upswing in the current fiscal year, witnessed a considerable erosion in both people and dollars for intramural and extramural projects. Given this context, it is remarkable that laboratories and centers are increasing their scientific exchanges on mutually beneficial projects.

One should not become too sanguine about these observations, however, because as already noted, they do not apply to all EPA laboratories and centers. In addition, they may not last in cases where they currently apply. The development of a useful dialogue and joint project planning between laboratories and centers are primarily the result of the willingness of knowledgeable people in both institutions who recognize the advantages of cooperation, rather than the existence of any formal mechanism that promotes their interaction. Given the fact that the circumstances encouraging such exchanges can change, through, for example, the departure of key personnel, this is an extremely fragile and ad hoc format for planning research and is no substitute for a more structured approach.

5. Intra and Inter-University Linkages

Examples of intra and inter-university contacts are presented below for each center. During the early existence of the Epidemiology Research Center, efforts were made to establish the center as a university-wide activity within the University of Pittsburgh and to build bridges to neighboring Carnegie-Mellon University. One mechanism for this effort was an executive committee which included representatives from a number of faculty departments at both universities to solicit grant proposals. However, none of these proposals was approved by the policy board, and the collaborative effort was eventually abandoned. At the present time the center is located within the School of Public Health, providing a focus for many activities of the Departments of Biostatistics and Epidemiology, with some involvement of other departments. The center is collaborating with Brookhaven National

Laboratory in developing risk assessment methods for the synfuels industry. Current attitudes at the center would promote broader inter-university and inter-laboratory collaborations, if funding were increased and if EPA had an epidemiologic studies program intramurally.

The NCGWR, a consortium of three universities located in two states, has addressed the problem of linkages from the very beginning of its existence. In addition to the consortium, the center has supported research projects with co-principal investigators at different institutions. For example, there is a laboratory and field project conducted at a superfund site in Texas that is directed by one investigator from Rice University and one from the University of Texas at Austin.

The Ecosystems Research Center has been very successful in marshalling a variety of talent to the center. Various units on campus, including the Department of Ecology and Systematics, the Department of Natural Resources, and the Boyce-Thompson Research Institute are active participants in the center's projects. The center's interaction with the Boyce-Thompson Institute has resulted in significant findings concerning acid deposition effects on the secondary infection of plants. Extra-university linkages facilitated by the center include working relationships with Woods Hole Oceanographic Institute and Oak Ridge National Laboratory as well as with EPA laboratories at Narragansett, Gulf Breeze, and Corvallis.

The center director of the AECTRC serves on the SAC of the Industrial Waste Elimination Research Center, thus providing center-to-center interaction. Researchers supported by the AECTRC are affiliated with the colleges of science and engineering at the university; center researchers also have additional research support from other government agencies or from industry.

6. Non-Center Considerations

There are a number of factors which influence the conduct of center business but which are not under the control of the center. A good example is the Epidemiology Research Center, which has had significant problems in its relationship with EPA. One set of problems related to the composition of the policy board, in particular the frequently changing chairmanship prior to the appointment, one year ago, of the director of the Health Effects Research Laboratory (HERL) at Research Triangle Park, N.C. The unstable leadership of the policy board led to changes in direction and uncertainty about the goals of the center. The second major problem resulted from EPA's termination of its intramural epidemiologic program. Except for individual epidemiologists at HERL, there was no epidemiologic research program or epidemiology "presence" within EPA to which the center could relate. The dissolution of epidemiology research within EPA was not accompanied by any contractual mechanism which might have given the center responsibility for carrying out the epidemiology mission of the Health Effects Research Laboratory, with linkages to research planning and work plan development in the Agency.

There have also been a number of positive results, attributable to the centers, within the broader scientific community outside of EPA. For example, the AECTRC has been involved in other educational activities such as a trilateral agreement to train Japanese environmental engineers under the Engineer Exchange Provisions of the U.S.-Japan Bilateral Agreement on the Environment. The attendance and participation at the two International Research Symposia on Ground Water reflect the prominent role that the NCGWR has assumed as a mechanism for transfer of research results to the multi-disciplinary Ground Water community.

D. EPA Management of the Centers Program

The centers program is managed by the Office of Exploratory Research (OER), which is a staff office within the Office of Research and Development at EPA headquarters and whose director reports to the Assistant Administrator for ORD. OER manages other research programs including the Peer Review-Investigator Initiated Competitive Grants Program and the Visiting Scientist Program, and serves as the lead ORD liaison with the National Academy of Sciences. Both the grants and centers programs have headquarters staff assigned to manage day-to-day operations, although during the current fiscal year each program lacked a permanent director for a number of months.

The Subcommmittee's review of the management of the centers program has focused on several issues. These include: 1) the nature of EPA guidance to and interactions with the centers; 2) reporting requirements and the number of programmatic and scientific reviews of center operations; and 3) the budget process.

1. EPA guidance for the centers

Despite the progress noted in some areas, major problems in EPA-center interactions persist. These, in fact, overshadow the positive features of the dialogue between the centers and most EPA laboratories and policy boards. Many of these problems can be traced to EPA/ORD headquarters and more specifically to the Office of Exploratory Research. More than one policy board chairman stated that he did not know what current ORD/OER policy was towards the centers' acceptance of non-EPA funds because prior guidance on this issue had shifted 180 degrees. Also, the previous Acting Assistant Administrator had opposed the use of extramural laboratory funds for specific center projects, although the incumbent Assistant Adminstrator has reversed this decision.

OER direction to the policy boards and to the centers is also inconsistent or nonexistent. This is reflected in the obscure guidance on preparation of an annual center report, the absence of a mechanism to integrate center research activities into ORD's planning process, the lack of a formally articulated conceptual framework on how center projects are to be judged relevant to EPA's mission and how they should support regulatory programs, confusion over whether the centers are EPA centers and only to be supported with Agency funds or whether they are university centers for which EPA provides

core support, and lack of clearly defined criteria for replacement of center directors or the renewal of centers. The absence of OER leadership to develop creative proposals to try to resolve these problems is disconcerting and represents an abrogation of responsibility. Discussion between OER personnel and the Subcommittee also indicated that it is not clear how knowledgeable or concerned the current OER leadership is about these problems and their effect on the program.

2. Reporting Requirements and Programmatic and Scientific Reviews of the Centers

Individual centers are subject to at least three kinds of review. These include: 1) programmatic review of center goals, operations and expenditures by the policy board; 2) peer review of project proposals and on-going research activities by a Scientific Advisory Committee; and 3) periodic administrative review by ORD headquarters, including OER. For each kind of review, center staff must prepare written position papers and/or proposals, with an accompanying rationale to present to the reviewers. Several center directors estimated that about 20-25% of their FY'84 budget of approximately $420,000 was expended on such reviews and administrative costs, while one director judged that more than 50% of his budget was absorbed by such activities. These expenditures included such items as travel and salaries and expenses.

The frequency of policy board meetings has varied from center to center and from year to year. At the AECTRC, for example, the policy board averages two to three meetings per year, while at the Epidemiology Research Center it has convened approximately five meetings since 1979. Both center and most EPA personnel were in general agreement that the policy board could meet once per year and retain an appropriate level of oversight. The peer review provided by the Scientific Advisory Committee was also regarded by most observers as adequate if carried out once per year, although the current practice is to meet somewhat more often. In addition to these sets of meetings are periodic administrative gatherings called by the OER director and staff to review such issues as the budgetary outlook and changing EPA peer review procedures. In addition, it is sometimes necessary for center directors or staff to make site visits to ORD laboratories. The total number of such meetings and reviews more readily explain why many center directors spend approximately 50% of their EPA funded time to manage administrative issues associated with the center. It also leads the Subcommittee to conclude that, for the amount of dollars allocated to the program, the centers are over reviewed and over managed.

3. The EPA Budget Process for Centers

The process of preparing, defending and allocating the budget for the centers can be summarized in one word--byzantine. A brief description of how this process works will help to illustrate the ORD management attitudes and approaches toward this program.

The budget cycle for a typical[2] center begins approximately six months (during April or May) before the allocation of funds for the next fiscal year. At that time OER provides each center with a target allocation so that the center can identify which research it plans to carry out within the dollar ceiling. The center director and staff prepare position papers for review by the policy board on what research projects should be carried over or phased out during the next fiscal year as well as identifying new research initiatives that can be funded under the target allocation. If new projects are approved by the policy board, center staff proceed to prepare formal research proposals for review by the Scientific Advisory Committee.

Assuming clearance through both the policy board and the SAC, the center "package" is submitted to the project officer. The project officer is very important to the center because he/she is the legal and institutional representative of record for the EPA and is responsible for monitoring the performance of the center and upholding EPA's obligations under the terms of the cooperative agreement. The policy board, de jure, deals with the center through the project officer but, de facto, the relationship is less clear because in some cases the policy board chair and the project officer are the same person, while in other instances at EPA, the latter works for the policy board chair in a supportive role.

Following his/her review of the center's budget package, the project officer prepares a decision memorandum which includes the comments of ORD headquarters' reviewers, attempts to reconcile differing views, and certifies that the proposed funds are sufficient to carry out the proposed tasks. The decision memorandum is forwarded to the director of OER. At this juncture of the process it is approximately mid-August, or nearly six weeks before the start of the new fiscal year. The OER task at this point is to actually locate money to fund the center. ORD's budget process does not specifically designate funds for a specific center, but rather provides a general account called the decision unit for "interdisciplinary research" which also includes the peer review grants program and a number of smaller, miscellaneous items. From this general funds category OER patches together a budget for the center which is then forwarded to the Assistant Administrator for concurrence. Assuming concurrence, the package is submitted for reviews and concurrence by the Grants Administration Division within the Office of Administration. This latter office is organizationally separate from ORD and is, in fact, headed by another Assistant Administrator.

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[2]Since each center is subject to a slightly different budget cycle this description does not conform exactly to the time frame of an individual center's funding year. The Subcommittee believes, however, that it has identified the key elements of the centers' budget process, if that process was synchronized with EPA's fiscal year planning cycle.

By the end of this review cycle several changes are likely to have occurred to the original package approved by the policy board and the Scientific Advisory Committee. If recent experience is a useful guide, the center would not receive its funding until long after the fiscal year had actually begun. Also, the actual level of funding is considerably lower than the original target allocation. In its fourth year of funding, for example, the Ecosystems Research Center received a target allocation of $680,000; its actual funding level was $420,000. Similarly, the National Center for Ground Water Research was directed to plan its fifth year program within a budget ceiling of $650,000; it received $420,000. In FY'84 all centers received the same funding--$420,000.

IV. FINDINGS AND RECOMMENDATIONS

A. Issues from the Charge to the Subcommittee

1. New Center Themes

The Subcommittee was asked by the Assistant Administrator for Research and Development to identify new environmental areas or themes that, in future years, will be of highest priority for the centers program. Before presenting specific proposals on this issue the Subcommittee strongly recommends that ORD and the Agency resolve the major problems that plague the existing centers program before even considering the establishment of new centers. At the present time it would be foolish to consider new centers before the current budgetary, leadership and management problems of the current program are corrected.

There are several minimum requirements that should be satisfied by ORD before it considers new center themes. These include:

a. Significant new funding is available

b. OER should define EPA's high priority research needs for abating health and environmental risk during the next five to ten years. OER should identify which of these needs can be addressed most effectively by university-based centers. Finally, OER should develop nominations for new center themes. For each of these three activities OER should consult with the SAB Subcommittee on Strategic and Long-Term Research Planning.

c. The solicitation process for new centers should be competitive.

Members of the Subcommittee have identified several environmental areas which they believe warrant consideration for center sponsorship by EPA. In addition, the Clean Air Scientific Advisory Committee (CASAC) of the Science Advisory Board, in a December 1983 report to the Administrator on Research Needs for Setting National Ambient Air Quality Standards, recommended high priority themes for new centers. ORD should consider the recommendations of both of these panels if the other minimum requirements are satisfied. These recommendations are as follows:

- Extrapolation of quantitative experimental animal response data for the prediction of human responses. Sponsorship of further research in this area through a center would contribute significantly to an understanding of the mechanisms of the responses to pollutant insults to both laboratory animal and human systems. Results of such work are directly related to developing the scientific basis for standard setting under most of the statutes that EPA is charged with implementing and enforcing.

- Research relating air pollution exposures to doses received by target sites within human populations. Developing an enhanced capability to assess pollution exposures is a critical element of risk assessment. Important components of a center organized to evaluate the exposure-dose-risk assessment links include: a) establishing relationships between concentrations at air monitoring sites to human exposures; and b) assessing biological responses to multiple pollutant exposures. While directly applicable to supporting EPA's regulatory responsibilities under the Clean Air Act, the research results of such a center can enhance EPA's exposure assessment for land and water pathways analysis and can provide scientific support for assessing the human health risks from air and water pollutants, hazardous chemicals and radiation.

- Evaluation of unused areas for waste disposal. EPA is currently surveying the disposal of toxic wastes in some relatively uninhabited or unused environments. For example, it is assessing the environmental and human health impacts associated with the incineration of hazardous wastes at sea. In addition, it is charged with establishing criteria for the disposal of high-level radioactive wastes. Waste sites for the latter, many of which are located in areas of low population density, are currently under review by the Department of Energy. Creation of a center(s) for desert ecology and/or microbial ecology, or expansion of the research program of an existing center, will directly support EPA's responsibilities under various statutes and will lead to a greater understanding of pollutant behavior and fate in media where the Agency's current depth of knowledge is limited.

- Application of biotechnology principles and techniques to pollution control. The evolving science(s) of genetic manipulation creates numerous opportunities for environmental scientists to better understand and neutralize highly toxic pollutants. Examples include the use of microbiological techniques to detoxify hazardous chemicals, such as some pesticides, in soil systems and the development of organisms that consume toxic substances without themselves being rendered toxic. EPA could potentially utilize such state-of-the-art practices for pollution abatement under most statutes that it

implements. In addition, a long-term, ample commitment of researchers and dollars to support a biotechnology center will hopefully increase the Agency's knowledge of this important scientific innovation.

- Research related to monitoring of ambient levels of contaminants in water, soil, and air. Accurate measurement of low levels of contaminants in the environment is an essential facet of any clean-up effort, be it Nation-wide or at a specific location. Problem sites need to be identified and progress in their remediation monitored. Creation of a university center in this broad monitoring area would generate new basic approaches for sampling and analysis and would complement the more applied work of EPA's Environmental Monitoring and Support Laboratories.

2. Scientific Review of the Centers

During its review of the centers program the Subcommittee reached a consensus that the concept of a centers program is worthwhile, that such a program has the potential to achieve high levels of research productivity if it is adequately supported by EPA, and that, in general, EPA should have a centers program. The research generated at most of the centers has generally been of high quality. The Scientific Advisory Committee review process of the current centers is appropriately focused and is carrying out its intended functions. The program has proved to be a vehicle for mobilizing talent from diverse academic sources, both intramural to the institution housing the center and frequently extramurally. In addition, the program has been partially successful in attracting funds from outside of EPA, thus magnifying the EPA investment. In short, despite EPA's underfunding of the centers, most of them have proven to be a worthwhile research investment.

3. Centers Program and ORD's Mission

Although the centers program is a part of ORD, it has not been clearly articulated how the program carries out the mission of the ORD or of EPA. As a result, there is confusion and reluctance on the part of ORD to encourage funding such items as graduate student research, even though such research is usually integral to a centers program. The ORD must communicate clearly to the centers what their role should be in research, education, and service.

Recommendations:

- ORD should create mechanisms to more closely integrate center activities whose those of its research laboratories and to encourage the laboratories to use centers in the same disciplinary area for research, but not for technical services such as proposal reviews. To the extent possible, each center should have a laboratory "constituency" with which to plan and/or carryout research.

- Long-term and short-term research goals and objectives need to be clarified.

- ORD should prepare guidance which clearly states the missions and goals of the centers.

- Exploratory studies should be supported.

- Centers should be encouraged to exchange staff scientists with other centers and with EPA laboratories.

4. Quality of Work

The work performed by the centers is usually of high quality (see Appendix D). However, the uncertainty of funding levels undermines center stability and hinders fundamental long term research.

5. Renewal of Centers

The low level of support for the centers has resulted in their not being centers. In drawing this conclusion, the Subcommittee has examined center sponsorship at other Federal agencies, such as the National Institute of Environmental Health Sciences (NIEHS) and the National Science Foundation (NSF). Either the amount of support for the centers program should be increased to realistic levels, or EPA should acknowledge that it cannot fund such a program and should terminate it. The Subcommittee has recognized several options:

a. If funding remains at the current level of $ 3.4 million ORD should consider:

   - reducing the number of centers from eight to a number which will provide more adequate funding - probably four or five centers, or

   - distributing funds on an unequal basis to the eight centers, or

   - terminating the program entirely.

b. If funding increases to a level such that each existing and/or new center would receive a minimum support of $800,000 to $1,000,000 per center, ORD should:

   - increase funding to the eight centers but not necessarily on an equal basis, or

   - add more centers

Funding of centers should be based on a three year cooperative agreement, followed by a second three year cooperative agreement. Competitive renewal should occur in the fifth year. If the center is competitively renewed, it would receive two additional three year cooperative agreements. If it failed to be renewed, it should receive 50% funding for an additional year (year 7) as a transition to a total phasedown.

A potential disadvantage of this fifth year competitive renewal is that it does not provide for long term tenure of funding that centers such as those funded by NIEHS have come to expect. Consequently, ORD may also wish to consider the renewal process followed by NIEHS or other Federal agencies as an alternative to the competitive renewal process described above.

6. Communicating Research Results

Technical exchange between the Agency and centers is mutually beneficial and should be encouraged. On the issue of technical transfer of information, the Subcommittee finds three areas of particular concern. These include:

a. information exchange;

b. technical transfer involving personnel exchanges; and

c. specific response to Agency initiatives, which are related only in principle to the research mission of the center.

Recommendations:

- OER should develop standard guidelines for an annual report of center activities. This report should be a substantive summary of all center activities (both EPA and non-EPA funded). OER should act to coordinate the dispersal of the reports to other centers, EPA laboratories, program offices, and other appropriate Agency personnel. OER should assume an active role in summarizing its supported research to the entire Agency.

- No more than 10% of core funding should be devoted to information exchange or technical transfer (items 6a and 6b). This should be a "rule-of-thumb" directive, and final decisions should be made by the center director.

- There exists a continuing need for EPA to make an internal organizational link between research and program initiatives. Something akin to the Office of Integrated Technical Analysis proposed by the National Academy of Sciences in 1977 remains a useful suggestion. The operation of the ORD research committees has, to date, failed to meet this need for integration of research.

B. EPA Management of Centers

In the Subcommittee's view, what is critically needed at the present time to promote the success of the centers program as a whole is a quality of leadership in ORD that understands what a centers program should provide to EPA, what factors lead to success or failure, and what management and budgetary resources are necessary for a successful program.

1. The centers are currently subject to reviews by the policy board for programmatic and budgetary oversight, by the Scientific Advisory Committee for peer review of the research program, and periodic reviews by ORD headquarters. There are currently an excessive number of such review meetings in relation to the amount of resources allocated to the centers. The net result is that administrative costs of running the program are too high relative to available dollars. The program is being over reviewed and over managed.

Recommendation: Both the Policy Board and the Scientific Advisory Committee should convene only once per year, ideally at the same time.

2. A number of institutional relationships relating to EPA's management of the centers program need to be clarified. These include the relationship between the project officer and the policy board; the stability of the policy board and the knowledge of its members; and the role of ORD headquarters and the Assistant Administrator in annual sign-off of support for the centers.

Recommendations:

- At the current level of funding the need for separate reviews by both a project officer and the policy board is not apparent. Where possible, the project officer and policy board chair should be the same individual, preferably a senior laboratory official who understands the technical basis of a center's program and is knowledgeable about ORD policy issues.

- Members of the policy board should be appointed for fixed terms, staggered to promote the continuity of knowledgeable membership while gradually encouraging new participants.

- At almost any level of funding, a review of a center by ORD headquarters need only occur when a center is up for a renewal decision, when there is a a change in leadership, or when a special problem arises. After the initial awarding of a center agreement to a university, ORD should delegate the sign-off authority for the center's annual support to the project officer. There is no need for the Assistant Administrator to annually approve the funding. One objective of this proposed delegation of sign-off authority is to ensure that budgetary authority resides at the same level of ORD where the responsibility for managing the program exists.

3. There is a need for OER to develop more explicit procedures concerning the replacement of the center director.

Recommendation: In the event a center director leaves the institution or is unable to carry out his/her duties, an acting director should be appointed on an interim basis by written mutual agreement with OER. A permanent director should be selected as soon as possible (the acting director could be an eligible candidate) to ensure continuity in the direction of the centers research program. The new director is expected to possess scientific and management capabilities at least equal to those of the previous director and must be acceptable to EPA staff and the policy board, with the advice of the Scientific Advisory Committee. The appointment of the new director should also be confirmed in writing between the center and OER.

C. The Budget Process for the Centers Program

1. The Subcommitteee reached several findings about the budget process.

a. The intensive preparation of the centers to develop and continue a research program within a given level of resources is subverted by the ORD/EPA budget process. What, in fact, occurs is that after extensive contingency planning by the centers and review by the policy board and the Scientific Advisory Committee, budgetary choices are made in the absence of a clearly defined rationale.

b. One of the central purposes of strategic research planning in any organization is to inform the budgetary process, i.e., to provide an analytical basis for prioritizing alternatives and selecting those which are affordable. The budgetary process should not subsume the planning function, for if this occurs identification and discussion of many potentially creative alternatives will not take place. The current ORD practice of patching together various funding accounts to fund centers, to allocate monies sustantially below the original budget ceiling, and then to provide the same amount of funds to each center after the fiscal year has already begun is counterproductive to good research management and is analytically bankrupt.

c. The budget process in any organization is characterized by complexity, but complexity need not obscure the lines of authority and responsibility for ensuring program success. The EPA/ORD budget process separates the authority of those individuals who provide funding for the centers from the individuals who are responsible for the day-to-day center operations. This separation of authority and responsibility, in practice, results in a situation where everyone is to blame and, therefore, no one is to blame. This is the very definition of bad management.

Recommendations:

- Allocations of resources should be received by the centers prior to the start of the annual project period. The project officer and the director of OER should work closely with the center directors and the EPA Grants Administration Division to assure that funds are transmitted expeditiously. The director of OER should be accountable and responsible for ensuring that resource transmission occurs in a timely fashion.

- ORD should identify ways of streamling the multiple layer of reviews in the centers' budget cycle including the delegation of more budgetary sign-off authority.

2. "Core" support for centers

Centers require a critical mass of professional staff, support staff, equipment, facilities and space and research funds to carry out a viable research program. Within this context, centers receive core support from EPA. Core support refers specifically to salary and service support allocated to individuals associated with a center, not including research support.

Recommendation:

- OER should identify which portions of a center's budget constitute the core budget and those elements that comprise funds for research. However, the Subcommittee does not assume that each center has the same core support needs. The support needed by most centers to maintain a high level of research productivity ranges from a minimum of $800,000 - $1,000,000 per year to a maximum of $2,000,000 per year (including both core support and research funds).

D. EPA Leadership for the Centers

1. Throughout the years of the centers' existence there has been no effective spokesperson or advocate within EPA, especially at ORD headquarters, to ensure the success of the program. As a result, the centers continue to be treated as orphans whose existence is tolerated, but they are not adequately supported or effectively utilized.

Recommendation: The advocate for the centers program must be the Assistant Administrator of ORD. Only the AA has the scope of authority and span of control to initiate actions that lead to more effective utilization of the centers as a major scientific resource within ORD.

2. The Subcommittee believes that the quality of leadership within OER has not been effective.

Recommendations: The following criteria should be adopted for selecting future directors of OER:

- committed to the EPA centers concept and the operation of the centers;
- committed to support of long-term research needs of the Agency;
- an advocate of optimal financial support for the centers;
- possess scientific competence and professional experience in managing a long-term research program;
- have the support and respect of the research community and senior policy officials at EPA;
- able to provide the intellectual leadership necessary for a centers program; and
- capable of clear communication of policy decisions and management guidance.

E. Role of the Centers

One point of consistent confusion encountered by the Subcommittee was whether the centers are EPA centers and only to be supported with EPA funds or whether they are university centers whose core support is funded by EPA. For the long haul, the latter approach is more desirable. The EPA support should be considered as base support used to initiate important centers at various locations. The EPA base support should be used as "leverage" to enhance the success of the center.

Recommendations:

- centers should be reviewed on a regular basis and be phased out/ terminated if performance does not yield sufficiently high quality research that benefits EPA.
- centers should seek a broad base of support and participate fully in the academic community without being obligated to only one sponsor.
- so long as both EPA and the centers contribute and benefit from the cooperative agreement relationship, there should be no time limit set for the duration of EPA support.
- EPA should have the management flexibility to alter the mix of centers to reflect its changing information requirements over the long-term. As the Agency's role as a sponsor of research in the Federal government evolves (for example, it is currently a primary sponsor of ecological research but not a primary sponsor of health research) so will its need for specific kinds of centers.

Appendix A

Charge to the Subcommittee on Strategic and Long-Term Research Planning

In December 1983 Dr. Bernard D. Goldstein, Assistant Administrator for the Office of Research and Development (ORD) formally requested the Science Advisory Board (SAB) to assist in the review of ORD's Research Centers Program. The Subcommittee on Strategic and Long-Term Research Planning was formed by the Executive Committee of the SAB to carry out that review.

Specifically, the Subcommittee has been asked to review the following issues:

1) Examining what environmental areas or themes will be of the highest priority for the centers program;

2) Assisting ORD in conducting a scientific review of the centers, associated with ORD's scientific and management review of the program;

3) Reviewing the effectiveness of the centers program as a means of carrying out ORD's mission;

4) Advising on the quality of the work performed by the centers;

5) Advising ORD on the issue of options for renewal of centers;

6) Examining how research results generated by both the Research Centers Program and the Peer Review Investigator Initiated Grants Program can be more effectively communicated to ORD's laboratories and to EPA's program offices.

Six research quality review criteria have been identified for use in evaluating the centers program:

- The Research Program - From a scientific point of view, is the research program well designed and focused? Has a specific research objective been identified? Within the context of the centers theme assignment, is the research objective of major interest to the scientific community? Will the research be useful to EPA or to anyone else?

- Research Quality and Control - Are there acceptable peer review procedures to ensure the quality of research projects and publications? Is the membership of the center's Scientific Advisory Committee (SAC) well qualified and relevant to the needs of the center? Does the SAC represent a national scope of interest? How has the SAC been utilized? Does it retain objectivity? What other measures have been taken to ensure research quality?

- Quality Assurance - What measures are taken to define the quality of research data generated? Are statistical methods being used in experimental design and data interpretation.

- Non-Center Considerations - Are there any considerations outside the center director's control that might impact on this evaluation?

- Communications - To what extent has there been interaction between EPA and the centers? Is there communication between the centers and the EPA laboratories and EPA's program offices?

- Intra-University Linkages - How well do the centers act as magnets to draw in other researchers within the University to participate in research projects?

Appendix B

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Appendix C

ORD Research Centers

Theme	Institution	Starting Date
Epidemiology Research Center	University of Pittsburgh, Pittsburgh, Pennsylvania	October 1979
Advanced Environmental Control Technology Research Center	University of Illinois, Urbana, Illinois	October 1979
National Center for Ground Water Research	Consortium: University of Oklahoma, Norman, Oklahoma; Oklahoma State University, Stillwater, Oklahoma; Rice University, Houston, Texas	October 1979
Industrial Waste Elimination Research Center	Consortium: Illinois Institute of Technology, Chicago Illinois; University of Notre Dame, South Bend, Indiana	October 1980
National Intermedia Transport Research Center	University of California at Los Angeles, Los Angeles, California	October 1980
Ecoystems Research Center	Cornell University, Ithaca, New York	October 1980
Marine Sciences Research Center	University of Rhode Island, Kingston, Rhode Island	October 1980
Hazardous Waste Research Center	Louisiana State University, Baton Rouge, Louisiana	October 1981

Appendix D

REVIEW OF THE
EPIDEMIOLOGY RESEARCH CENTER

April 2-3, 1984

INTRODUCTION

The Site Visit Team met at the Graduate School of Public Health, University of Pittsburgh, on April 2 and 3, 1984. Team members included: Robert Frank, Michael Lebowitz, Morton Lippmann, Frank Speizer, James L. Whittenberger, Terry F. Yosie (SAB Director) and Robert Flaak (Executive Secretary).

GENERAL COMMENTS

This was one of the first group of centers established by Cooperative Agreements with EPA, and is now in its fifth year. It is the only center primarily concerned with health effects of environmental pollutants. However, there are several cogent reasons why this center has not reached the maturity of purpose and program which one would normally expect in a five-year old center. These factors were discussed in Subcommittee meetings in February and March, and were known to the site visit team prior to the visit. The site visit extended our knowledge of the problems, as well as the improvements made by the university participants in the past eight or nine months. Some of the problems are common to all the centers; others are peculiar to this center. The problems will be listed now and some of them amplified later.

General Problems:

Budgetary uncertainty, reductions, misunderstandings.

Lack of policy direction and consistency in Office of Exploratory Research.

Special problems of Pittsburgh Center:

Chaotic history of policy board - frequent changes of chairmanship, unstable policy guidance.

Absence of any laboratory or program activity in ORD to which the center could relate (the epidemiology intramural program was abolished by EPA in 1981).

CONDUCT OF THE SITE VISIT

The center director provided a substantial set of documents in advance, which gave the site team a good background for the visit. By agreement, Dr. Enterline also developed an agenda which would provide the site visit

team opportunities to hear from and to interrogate key faculty members of the center. On the second day, the site visit team visited the facilities and had extensive discussion with the center director (following an executive session).

Two persons important to the center were not present at the site visit: Professor Lewis Kuller, Chair of Epidemiology, is away on sabbatical leave, and Dean Raymond Seltser was out of town. Dean Seltser called the Chair of the site visit team to express his strong support of the center; this is more than routine support because Dean Seltser is himself an environmental epidemiologist.

OBSERVATIONS AND CONCLUSIONS

A. Leadership of the center.

Until September 1983, the director of the Pittsburgh center had been Professor E.P. Radford, Jr., who has resigned and left the university. Granting that EPA's contribution to the cooperative agreement was deficient and sometimes not in the best interests of the center, it is also apparent that the quality of leadership at the institution was different under Radford than it is under the new director, Philip Enterline. Since September 1983, the center has identified four major themes for future research, has organized the role of the advisory committee and appointed a chairperson for the first time, has occupied integrated space, has developed regular staff meetings, and in other ways has created a sense of unity and purpose.

B. Themes, or environmental health research areas of highest priority.

During the first four years of the center, there was no focus for long-term research. The EPA solicitation which led to the establishment of the center had no impact on the activities of the center. A large amount of technical advice was sought by various components of EPA, including the laboratories, and this burden of service continues to the present. The policy board set a limit of 20% of the budget for technical services, but this limit was not adhered to. At one point, the center was asked to serve as "Project Officer" for all EPA epidemiology contracts.

At another time the policy board asked the center to set up five task forces to determine EPA priorities for long-term research. Task Force members thought they were planning EPA's research program, not the center's program.

The planning effort that started last fall identified three research themes to which a fourth was recently added. These are four of the topics on the agenda--studies relating to hazardous waste sites, monitoring of adverse reproductive outcomes, studies of certain indoor air pollutants, and methodology of risk assessments. In general these involve critical "state-of-the-art" reviews, coupled with possible specific research plans. The topics identified are appropriate research themes for an environmental epidemiology center.

C. Quality of the research program.

In terms of epidemiologic studies attributable to EPA's support of the center, there is little to evaulate. This is not a reflection on quality of faculty in the center, because most of those faculty have been doing good or excellent research with sponsorship by other sources. Many publications are attributed to the center, but most of these are publications of proceedings of the annual symposia sponsored by the center. Some of the symposia have been of high quality and responsive to high priority needs; others have been unremarkable.

Dr. Enterline is a widely respected and productive statistician and epidemiologist, one of the pioneers in occupational epidemiology in this country. He is thoroughly aware of the needs and is a practitioner of high standards in quality control, peer review, and uses of statistical methodology. His associates in research are also of high quality, including some who are not identified with the center (and probably should be).

The Scientific Advisory Committee has been very little used until this year. The SAC now has a chairman, a regular meeting schedule, and a principal function to review research proposals and participate in quality evaluation.

D. Interactions with EPA.

EPA's project officers were complimented for their understanding and their efforts to assist the center, but nothing else in EPA's role was praiseworthy. In 1980 the center was informed by the Office of Exploratory Research that $500,000 was available for research projects. The center prepared and submitted nine research projects for peer review, only to learn that the $500,000 was supposed to be the core budget for the second year. Since eight of the nine projects were already committed, the core had to be reduced from $346,000 in the first year to $130,000 in the second year. This was only one example of the "screw-ups" in the core budget.

The center felt obliged to respond to all requests from EPA, whether from a regional office, a laboratory scientist, or headquarters. Center staff thus did feasibility studies (e.g., arsenic in drinking water), planned research protocols that were never used (Love Canal), organized workshops, reviewed grant proposals, etc. The center has not attempted to quantify this service to EPA, but estimates it at 30 to 40% of center effort.

The policy board has been the major source of input from EPA, in spite of the frequently changing chairmanship, lack of guidance as to what the center was supposed to accomplish, etc. There was no input from research committees when the policy board asked the center to establish the five planning task forces and no feed-back to the center as to whether the task force reports had any impact on EPA research planning. As one senior staffer in headquarters described the role of the policy board, it was a "deplorable state of affairs."

EPA never communicated clearly to the center what it's role in research, "education" and "service" should be. The center used EPA funding for establishing two courses in Environmental Epidemiology in the School of Public Health, for supporting student research projects, and for the annual symposia (which were considered "education"). Eventually the policy board put a budgetary limit of 5% on student projects. They also approved use of 20% of the budget for "service," but made no effort to monitor this restriction.

CONCLUSIONS

A. The first four years of this cooperative agreement should be largely ignored in evaluation of this center for renewal. Most of the fault was EPA's. Reasonably good progress has been made since August 1983 because of new leadership of the center, stabilization of the policy board under the present chairman (Director of the Health Effects Research Laboratory), and efforts of the project officer.

B. Effective integration of the center into EPA's long range research and research planning faces formidable handicaps. Effective linkage with EPA is impossible until EPA re-establishes epidemiology as an important intramural program.

C. Although scientists in the center are excellent, the center is using faculty resources who are at the institution, but not identified with the center. This is particularly true in the areas of environmental exposure measurement and reproductive biology, two areas which are very important in the center's program.

D. The center should be more aggressive in seeking non-EPA support for center-related research and more willing to identify extramural support they already have, as closely related to center objectives.

E. Technical service activities should be curtailed in favor of greater emphasis on research. Center funds, such as they are, should be conceived as core support for faculty and specialized facilities, supplemented by project support from public and private sources.

F. In fairness to the University of Pittsburgh, another three-year renewal period should be considered, with competitive renewal by the end of the seventh year (May 1986).

REVIEW OF THE
ADVANCED ENVIRONMENTAL CONTROL
TECHNOLOGY RESEARCH CENTER (AECTRC)

April 16, 1984

INTRODUCTION

The site visit was held on Monday, April 16, 1984, at the Engineering Experiment Station of the College of Engineering. Members of the site visit team present were: Clayton F. Callis, Francis C. McMichael, James H. Porter, Terry F. Yosie (SAB Director), and Robert Flaak (Executive Secretary).

The team was hosted by: Dr. Richard S. Engelbrecht, center director and Dr. William A. Cawley, Deputy Director, EPA IERL, Cincinnati, center project officer.

SUMMARY

The site visit team concluded that the Advanced Environmental Control Technology Research Center (AECTRC) is well managed; the research is appropriate to the center's mission; the quality of the research is excellent; the research team demonstrates enthusiasm; a cooperative spirit exists between the individual researchers and the center; and the productivity of the research effort has been high. This general status of AECTRC has been attained in spite of program budget cuts and confusing signals received from EPA Headquarters because of:

a) the management skills of the center's director;
b) the commitment of the university researchers to the center and the auxilliary support they lend to the center through the excellence of their individual reputations; and
c) the direction provided by the center's EPA project officer in directing the center through EPA's management and budget maze.

The review team concludes and recommends that:

a) the research conducted at this center is appropriate and beneficial to the Agency;
b) the Agency provide consistent guidance and support of this center at the headquarters level of ORD; and
c) the annual funding commitment to this center be increased by at least two-fold so that the center can effectively carry out its mission.

AECTRC RESEARCH PROGRAM

The center's research program and its mission is best described in "Summary of Research Activities, 1983" the report from the center director. A copy of the director's report is available for review in the SAB's offices. The program focuses on air and water pollution control research. Near-term research

examines biological degradation of pollutants on activated carbon, activated carbon regeneration, precharging aerosols, H_2O_2 and ozone oxidation of dissolved hydrocarbons. Longer range research is examining super critical fluid extraction. Each of the research projects focuses on gaining a fundamental understanding of mechanisms so as to improve processes.

The researchers are primarily professors from civil and chemical engineering and their graduate students. The research projects often involve interdisciplinary teams. The research staff has excellent credentials and their reputations lend to the credence of the center's activities. Much of the work conducted by the researchers is not funded through the EPA and the center. Thus, the Agency gains by having highly trained staff who are not fully supported by the Agency working on projects.

The quality and productivity of the AECTRC research program are good. Forty-two (42) peer reviewed journal articles have been produced by the program and 12 of these have been generated through the research effort. The center has excellent facilities and is well equipped to conduct research. Again the Agency gains since much of the facility and equipment is supplied by the university and not through EPA funding.

The center has attracted funds from outside of the EPA, for example:

A project sponsored by the Army Corps of Engineers to examine biodegradation as a means of decontaminating soils.

The center has also been involved in other activities such as entering an agreement to train Japanese environmental engineers under the Engineer Exchange Provisions of the U.S. - Japan Bilateral Agreement on the Environment. Additionally, the center has sponsored seminars to bring together expertise from around the country to discuss current research problems.

It is concluded that the center has productively used its EPA funds, and its research is focused and of high quality.

MANAGEMENT AND BUDGET ISSUES

The center receives direction from the Agency through two mandatory groups:

The center's policy board, which establishes appropriate areas to conduct research and establishes guidelines for interaction with the Agency; and

The center's Scientific Advisory Committee, which reviews and approves individual research proposals, follows ongoing research and with the policy board conducts periodic program reviews.

The activities of the policy board and Scientific Advisory Committee are funded by the center's budget. Thus the management of the center and the support of the mandatory groups become a part of the fixed administrative costs of operating a center. This cost amounts to $200,000-$250,000 annually. At a one million dollar funding level this amounts to 20 to 25 percent cost for administration which is reasonable. At the current $400,000 total funding level the administrative cost range from 50 to 63 percent of the total budget which is clearly out of proportion. The center feels that both committees serve useful functions. Thus, either the center funding should be increased since the incremental funding would be applied to direct research support, or the administrative budget be reduced primarily by reducing the administrative burden of the policy board and Scientific Advisory Committee.

Currently the center has only $150,000 to apply to research, which makes it difficult to support ongoing research and impossible to start new research projects. Most of the center's problems have been associated with inadequate budgets relative to the original concepts of the centers, not receiving clear and timely signals from the Agency as to the level of annual funding to be received, and not receiving the funds when they were expected. Thus, the center has had to operate on university budgets while awaiting EPA funding.

This has made it difficult for the center to develop adequate research plans and placed significant strains on the relationship between the center and the EPA. It is clearly to the benefit of the Agency to relieve these strains.

OTHER AGENCY - CENTER INTERACTIONS

A major function of AECTRC is to transfer technology and information it has developed to the Agency. The center has attempted to accomplish this function through seminars and through having members of the Agency on its policy board and Scientific Advisory Committee. Additionally, the center publishes its work in refereed journals. Thus, the extent that this information is not being disseminated in the Agency tends to reflect on the lack of interest by Agency personnel in the research efforts, rather than on the center.

CONCLUSIONS AND RECOMMENDATIONS

It is clearly to the benefit of the Agency to have outstanding university scientists and engineers working on long-range environmental problems. The AECTRC program effort clearly demonstrates these benefits. To the extent that centers can be developed which exhibit the qualities of this center, the program should be championed and supported by high level personnel within the EPA, certainly including the Assistant Administrator for Research and Development.

The Advanced Environmental Control Technology Research Center deserves continued support and its annual funding level should be increased to a level between 1.0 and 1.6 million dollars. Further, the funding should be committed sufficiently in advance of its actual receipt so that the center can more effectively plan its research program. Finally, funding should be received when due so as not to place a strain on the university's cash flow.

REVIEW OF THE ECOSYSTEM RESEARCH CENTER

April 23, 1984

INTRODUCTION

The site visit team met with the staff of the Ecosystems Research Center at Cornell University in Ithaca, New York on April 23, 1984. The team members include: Leonard Greenfield, Joseph Koonce, John M. Neuhold (Chairman) and Robert Flaak (Executive Secretary).

The site visit was conducted in a relaxed atmosphere with the intent to keep the discussions at a dialogue level. Presentations were informal, allowing opportunity for the site visitors to ask questions, make statements for reaction and to generally get a "feel" for the ecosystem center's research operation, its staff, students, past performance, future plans and capabilities.

The site visit team centered its discussions with the staff of the Ecosystems Research Center staff about the central theme of the purpose of the centers program: 1) fundamental ecosystems research; 2) interaction with intra- and extra- university peers; 3) interaction with EPA laboratories; and 4) interaction with EPA program offices. After gaining their reactions, the team met in executive session to evaluate their individual observations and come to a concensus with their assessment of the center. This report is a summary of this assessment.

ECOSYSTEM RESEARCH CENTER ORGANIZATION

The center is now in its fourth year of existence having been established with the objectives to: 1) identify the fundamental principles and concepts of ecosystem science and the determination of their importance in understanding and predicting the responses of ecosystems to stress; the description of the basic mechanisms that operate within ecosystems and the stability of ecosystems in the face of stress; and 2) to evaluate their applicability of these theoretical concepts to problems of concern to EPA through a consideration of retrospective and other case studies.

The center is led by Dr. S.A. Levin assisted by Dr. Barbara Bedford and Dr. Mark Harwell with an on-campus complement of scientists from such varied sources as the Boyce Thompson Research Institute, the Department of Ecology and Systematics and the Department of Natural Resources. A viable and energetic group of young post doctoral students, or research associates, and graduate students round out the complement. A program of visiting scientists working with the center on the Cornell campus for extended periods adds a dynamic sense of diversity to the group.

The work plans of the center are reviewed by a Science Advisory Committee comprised of group of eminent ecologists including: Herbert Borman, Crawford Holling, Fred Mackenzie, Frank Rigler, David Schindler, John Steele, and George Woodwell.

The work of both the staff and the Science Advisory Committee is in turn evaluated by a Science Review Committee comprised of an independent but equally eminent group of ecologists including: Jerry Franklin, Eville Gorham, David Reichle, Paul Risser, and Richard Wiegert.

ACTIVITIES AND ACCOMPLISHMENTS

During the three years since the initiation of the center, 86 reports and publications have been produced by its staff. Fifty five of these were as a direct result of EPA support. The remaining 31 were produced by the staff during their tenure at ERC even though the work was not supported by EPA. In addition to the publication record the staff has been invited to present papers and seminars at a variety of meetings and institutions. Some 56 such presentations have been made.

The quality of the work appears to be high. Most of the papers are published in peer reviewed journals or are published as books which also undergo peer review. Several of the reports are issued as reports of the center which also undergo a peer review before publication. The content of the reports and papers range from theoretical considerations of environmental questions to applied resolution of various environmental problems. One of the major significant efforts of the center is the conduct of workshops dealing with synthesis or integration sciences. Their effort in ecotoxicology is a good example of such synthesis work which will likely result in the definition of an emerging science of immense importance to EPA. Further details on publications, reports and presentations are available in the SAB's offices.

INTERACTION WITH EPA LABORATORIES AND PROGRAM OFFICES

The staff of the center have either been asked by or volunteered their services to several EPA laboratories and program offices. Notable among these is the cooperative efforts that have evolved between the center and the Gulf Breeze Laboratory with the Clean Water Act Section 403 (C) and the Newport/ Corvallis Laboratory with Section 301 (H). The staff at the Gulf Breeze Laboratory have volunteered their satisfaction with the interaction, which resulted in the definition of methodology which will sense ecosystem effects from ocean drilling activities.

Considerable time and effort is spent with "outreach" activities to the institutions within EPA. This activity has resulted in requests for assistance which sometimes are not relevant to the objectives of the center, but which most of the time result in mutually beneficial activity.

GENERATION OF EXTRAMURAL SUPPORT

The center has been very successful in generating support from sources other than EPA for activities which ultimately will benefit EPA's mission. For example, the staff has been successful in obtaining research and training funds from the Andrew W. Mellon Foundation for the program in ecotoxicology. Research support has come from NSF, EPRI, Hatch Act Funds, McIntire-Stennis, and the U.S. Forest Service.

DISCUSSION AND CONCLUSIONS

The goals and objectives of the center are most relevant to the mission of EPA. The nature of many of our environmental problems and the intent of much of our regulatory legislation requires a sound understanding of ecology, an understanding that cannot be gained from existing textbooks on the subject. Theoretical concepts need generation, testing and ultimately application. The objectives of the center and the center's performance on those objectives seem to us to be right on the mark.

The leadership demonstrated by Levin is unquestionably responsible for the success of the center to date. He has been responsible for putting together a group of scientists committed to applying theoretical knowledge to EPA's applied problems. He has been successful in forging diverse groups into producing scientific units. And he has been successful in opening and maintaining dialogues with prospective EPA user groups. In spite of these accomplishments in administrative leadership, Levin's real strength lies in his ability to generate ideas and by so doing to stimulate others into following his lead.

Much of the everyday administration - the incessant meetings with people from EPA, the incessant reviews, the changes in signals from the centers program-all serve to detract Levin and his cohorts from the substantative science that needs to be accomplished and which they are capable of doing.

We find it difficult to imagine any laboratory group that could be more productive than the staff of this center. Their record of accomplishment in the three short years of their existence is truly remarkable. Much of what has been accomplished has been done with less than optimal funding. Worse, it has been done with an uncertainty of funding that requires too much time of the leadership and makes the planning of a significant long-term program a frustrating experience.

The center staff have spent a lot of time communicating their capabilities to various institutions within EPA often with the help of their policy board which is comprised of representatives from the laboratories and the program

offices. Increasing communications through the dissemination of the products of the center might serve to make the laboratories and program offices aware of the center's capabilities and thus increase the value of the center to EPA.

RECOMMENDATIONS

1. The center and its activities must continue. It is too valuable an asset for EPA not to support.

2. The center and its activities are too heavily reviewed. Too many demands are made on the center director taking him away from more productive science efforts. An effort should be made to reduce this administrative overkill.

3. The Assistant Administrator of ORD or his designate should make an effort to encourage the laboratories and program offices with needs in the ecological arena to make use of the center.

4. The level of funding should be increased to what this committee and the director of the center believe is an optimal level, about $850,000 per year. Funding should be made in blocks of at least three years and preferably five.

REVIEW OF THE
NATIONAL CENTER FOR GROUND WATER RESEARCH

April 24-25, 1984

INTRODUCTION

The National Center for Ground Water Research was one of the first three centers established by the Environmental Protection Agency. The center is a consortium of three universities: Rice University, Oklahoma University, and Oklahoma State University.

The three present co-directors have worked together since the initation of the center. The center also has had the same project officer, there have been only two chairmen of the Policy Board, and the members of the original Science Advisory Committee have remained in place. Thus, the Center has had constancy of management personnel.

The site visit team, Raymond Loehr, Keros Cartwright, Richard Conway, and Francis McMichael accompanied by Robert Flaak of the EPA Science Advisory Board, reviewed the Center in Houston, Texas on April 24-25, 1984. The team met at Rice University to facilitate travel and minimize the time involved. The relevant center activities at all three universities and at the EPA Robert S. Kerr Environmental Research Laboratory (RSKERL), Ada, Oklahoma were discussed.

The individuals who met with the review team included: (a) the three center co-directors: Dr. C. Herbert Ward, Rice University; Dr. Norman Durham, Oklahoma State University; and Dr. Larry Canter, Oklahoma University, (b) the project officer for the center, Mr. M.R. Scalf, RSKERL, (c) the chairman of the center policy board, Mr. Clint Hall, RSKERL, and (d) two principal investigators of projects supported by the center, Dr. Mason Tomson and Dr. Phil Bedient.

Several annual reports and work plans were provided to the review team prior to the visit. These documents identified the projects that have been supported by the center and how specific research projects were chosen.

The discussion during the review focused on the operation of the center, the quality of the projects, how research objectives are identified, the role of the Science Advisory Committee (SAC) and the policy board (PB), and other considerations that affect the performance of the center. In addition, prior to the visit, the review team identified several general questions that served to focus much of the discussion. The specific projects were not reviewed in detail. Such review had been done by the SAC and other groups.

GENERAL

The following are general observations and conclusions that resulted from the site visit:

- There continues to be a need for a center devoted to Ground Water research that receives EPA support. This need is particularly important because of pressing RCRA and CERCLA issues related to uncertainties about mechanisms of transport, contaminant transformations, and approaches for contaminant control.

- To operate effectively, EPA should provide greater consistency of direction and constancy of support. The centers need: (a) a clear confirmation of the intended role of the center, and (b) an increasing base of support that can be counted on.

- The current level of EPA support, $420,000, is inadequate. A minimum funding level of about $1,000,000 per year should be provided to maintain a strong and relevant Ground Water research center.

- The center should be able to acquire other EPA (non-base) funds to create a critical mass of project activities.

- The center should be free to seek and acquire non-EPA support for needed research and not rely only on the available EPA support.

- For the dollars that are involved, excessive management, reporting, and review now is required by EPA.

- Ground Water research requires multidisciplinary talents and efforts, such as is available from the current consortium.

SPECIFIC QUESTIONS

The following indicates the questions used by the review team to arrive at an understanding of the center.

A. What are the strengths and weaknesses of the center?

The strengths include:

-- ability to cross departmental and institutional barriers to have the best individuals work on specific problems

-- development of strong researchers now focusing on Ground Water research rather than on other issues

-- development of young faculty to be front-line researchers in the area of transformation and transport of contaminants in the soil and ground water

-- access to a real field site (CERCLA site) and joint collaboration of researchers and projects at the site

-- interaction with RSKERL avoids duplicating on-going studies

-- development of well trained students (scientists and engineers) who have worked on projects and continue related efforts in subsequent positions

-- broad information and knowledge exchange through conferences and workshops

-- courses related to Ground Water now taught at the three universities that did not exist before the center was established

The relative weaknesses include:

-- current level of funding

-- lack of clear direction from EPA

-- geographical separation

B. Is it desirable to have a consortium of universities be a center?

The geographical separation, potentially different interests of three universities and administrative inefficiency and overhead can be problems in having more than one university be a center. However, none of these items appears to be a real problem for this center. The administration of the center appears to be done well, the dollars spent for administration are low, and the co-directors appear to get along well. In this case, a consortium is needed since no single university has the broad talent and expertise that are needed. In addition, a wider base of qualified researchers is available.

C. Has the financial support received by the center been used satisfactorily?

The center has attempted to use the available resources broadly and, in previous years, has acquired supplemental funding to broaden its research efforts. The center showed imagination in choosing to work with the state of Texas on the Conroe hazardous waste site and to use the site as a field laboratory.

The center directors have attempted to leverage the available support in an appropriate manner. However, the current level of support results in a deadening constraint on what can be done by the center.

D. What does the center accomplish or provide that could not be accomplished by individual investigators without the center?

The principal investigators supported by the center probably all could be successful in acquiring competitive grants from other sources. However, the center causes the researchers to focus on Ground Water research, to interact with each other and at times to work as teams, and to engage in multidisciplinary research. The center allows researchers to avoid the pitfall of viewing a problem too narrowly. In addition, the contribution from the three universities to the center and to Ground Water research has been greater than that identified in the annual project work plans.

E. How are appropriate research efforts identified by the center for support?

The approach is as follows: (a) pre-proposals are solicited and are reviewed by the center directors and RSKERL scientists and engineers for relevance and to avoid duplication of other efforts, (b) full proposals are prepared and reviewed and ranked by the Science Advisory Committee, (c) co-directors use the SAC ranking to determine the projects that are supported, and (d) the policy board approves the projects and the yearly work plan. The SAC is independent of the policy board and are advisors to the co-directors. In one year when there were more funds, 40 pre-proposals were received and reviewed, 16 full proposals were submitted and reviewed and ranked by the SAC, and six projects were funded.

F. Is there too close or too loose a relationship with RSKERL?

There is a close involvement between the center and RSKERL. However, the relationship appears to be rational, since RSKERL has a major component of the EPA Ground Water research program. There is no indication that RSKERL exerts undue influence on the center. The center decisions concerning research directions do not appear constrained by the RSKERL involvement. The center is an independent entity.

G. Is a center the appropriate mechanism for long-range ground water research?

Given the constraints on the EPA research efforts, a center is an appropriate mechanism to assure long-range research related to Ground Water. The current center has focused on the fate of organics in the subsurface. This is an appropriate focus for this center since the available resources do not permit a very broad focus.

H. Have the research efforts supported by the center been of a long-range nature?

In developing its program, the center has moved in this direction. Some of the best work is fundamental and clearly identified new, important phenomena about partitioning and transport in Ground Water systems. This and other research supported by the center is of a long-range nature and requires considerable time and sound intellectual capability to bring to completion. Such fundamental research is purposely and properly balanced with applied research projects that also are of a long-range nature.

I. Have the research efforts supported by the center been technically and scientifically sound?

The written research proposals that were provided and the discussions with the two principal investigators indicate that the current projects are sound and are of high quality. The internal peer review provided by the SAC is of great assistance in assuring this for the future. The discussion indicated that the research has become better as the center activities have matured.

The center has held conferences in which the center research is presented and critiqued by knowledgeable individuals. The results are published in pertinent, peer reviewed journals. The continuing review by various teams helps insure that the research is sound. The frequency of such review should be reduced with the SAC reviews being the primary project review mechanism.

CONCLUSIONS

Based on the quality of research supported by this center and the successful development of a cadre of effective interdisciplinary researchers, the site review team feels that, to achieve its full potential, the current NCGWR should continue to be supported by EPA and the level of support should be increased.